

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : SHIMADA PHYS &amp; CHEM IND CO LTD

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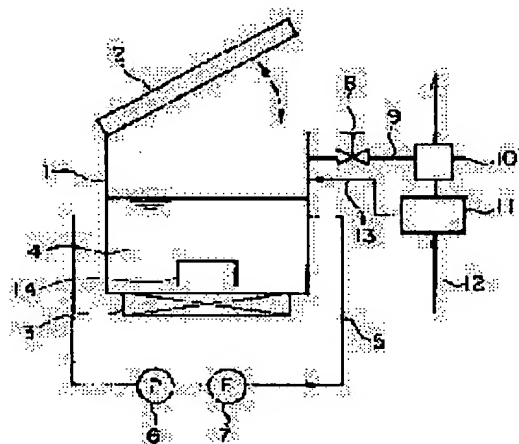
(72)Inventor : KITAGAWA KENICHI

## (54) ULTRASONIC CLEANING METHOD

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To attain high cleaning effect without using a vacuum pump, a compressor and the powder source by charging a material to be cleaned into a cleaning vessel having a ultrasonic generating source, deaerating the cleaning vessel and then ultrasonically cleaning the material to be cleaned while pressurizing the inside of the cleaning vessel.

**SOLUTION:** When cleaning, the material 14 to be cleaned is charged into a cleaning solution 4 and the cleaning vessel 1 is sealed with a cover 2 to be closed. Next, a discharge pipe 9 and ejector 10 are communicated with each other with a stop valve 8 opened and a compressed air is supplied to the ejector 10 by operating a switch valve 11. Air in the cleaning vessel 1 is sucked to reduce pressure in the cleaning vessel 1 and to deaerate air present in a gap in the material 14 to be cleaned and the material 14 to be cleaned is roughly cleaned by the flow of the detergent 4 due to the aeration. Successively, the cleaning vessel 1 is pressurized by closing the stop valve 8, switching the switch valve 11 and charging the compressed air from a pressure pipe line 13 into the cleaning vessel 1. Then, the supersonic vibrator is driver to ultrasonically cleaning the material 14 to be cleaned.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The ultrasonic-cleaning approach characterized by cleaning ultrasonically, throwing a washed object into the washing tub which has an ultrasonic source of release, and pressurizing the inside of a washing tub after reduced pressure deaeration.

[Claim 2] The ultrasonic-cleaning approach according to claim 1 characterized by using the compressed air used as a source of reduced pressure which decompresses the inside of a washing tub at the time of application of pressure.

[Claim 3] The ultrasonic-cleaning approach indicated by either of claims 1 and 2 characterized by attracting the air in a washing tub by emitting a compressed air from ejector mechanism, performing reduced pressure deaeration, supplying said compressed air in a

washing tub, and pressurizing it.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the approach of washing the article for which high cleanliness, such as a substrate of a precision machinery component or a common machine part, and electronic parts, is needed.

[0002]

[Description of the Prior Art] Since the cleaning effect by the supersonic wave was low when cleaning said each conventional article ultrasonically, washing might become impossible.

[0003]

[Problem(s) to be Solved by the Invention] Moreover, since the vacuum pump and the compressor were equipped when pressurizing and decompressing, it became large-sized as a washing station, and there was a fault that a power source had to be secured about each of a vacuum pump and a compressor. Then, in this invention, it is going to solve by cleaning a washed object ultrasonically, pressurizing, after deaerating a penetrant remover.

[0004]

[Means for Solving the Problem] In order to solve said technical problem, this invention cleans the inside of a washing tub ultrasonically, pressurizing after

reduced pressure deaeration, after throwing a washed object into the washing tub which has an ultrasonic source of release, and constitutes the ultrasonic-cleaning approach which uses the compressed air used as a source of reduced pressure which decompresses the inside of a washing tub at the time of application of pressure.

[0005] Moreover, the air in a washing tub is attracted by emitting a compressed air from ejector mechanism, reduced pressure deaeration is performed, and the ultrasonic-cleaning approach which supplies said compressed air in a washing tub, and pressurizes it is constituted.

[0006]

[Embodiment of the Invention] It forms so that it may seal with the lid 2 which can open and close the washing tub 1 freely, as it is shown in drawing 1, when the equipment used for an approach is explained before explaining this invention approach, and it filters with the pump 6 and the filter 7 which fixed the ultrasonic vibrator 3 which makes the bottom wall of the washing tub 1 generate a supersonic wave, held the penetrant remover 4 in the washing tub 1, and formed a penetrant remover 4 in circulation piping 5, and it makes circulate.

[0007] On the other hand, the exhaust pipe 9 which has a stop valve 8 is formed in the upper part of the washing tub 1,

and it connects with ejector mechanism 10. The compressed-air exhaust pipe 12 which supplies the compressed air through the change-over bulb 11 is connected to this ejector mechanism 10. Furthermore, the change-over bulb 11 connects one side to the washing tub 1 through pressure piping 13, sends the compressed air, and can pressurize it now. In addition, 14 in drawing is a washed object.

[0008] If this invention approach is explained using said equipment, a washed object 14 will be thrown into a penetrant remover 4, a lid 2 is closed, and the washing tub 1 is sealed. Next, open a stop valve 8, an exhaust pipe 9 and ejector mechanism 10 are made to open for free passage, the change-over bulb 11 is operated, and a compressed air is sent to ejector mechanism 10.

[0009] The air which existed in the clearance in a washed object 14 is also deaerated at the same time it attracts the air in a washing tub, and decompresses the inside of the washing tub 1 and attracts the air in the washing tub 1 by this reduced pressure deaeration by sending and emitting the compressed air to this ejector mechanism 10, and rough washing of a washed object 14 is performed by the flow of the penetrant remover 4 accompanying this deaeration.

[0010] Then, in a stop valve 8, if the closing change-over bulb 11 is switched, the compressed air will be supplied in the

washing tub 1 with pressure piping 13, and it is the inside of the washing tub 1 3 kg/cm<sup>2</sup> Extent is pressurized. It washes by driving an ultrasonic vibrator 3 in the case of this application of pressure, and irradiating a supersonic wave at a washed object 14.

[0011] When the supersonic wave was impressed pressurizing after deaerating a washing tub like this invention approach, as shown in drawing 2, high sound pressure was obtained rather than it performed ultrasonic cleaning after ordinary pressure and deaeration, and the high cleaning effect was acquired.

[0012]

[Effect of the Invention] This invention is what was constituted as mentioned above, and the air which rough washing of the washed object is carried out, and exists under reduced pressure in the clearance between washed objects is deaerated. Moreover, it is deaerated under reduced pressure, and in order to clean ultrasonically, pressurizing the penetrant remover to which the cleaning effect by the supersonic wave became high, a cleaning effect becomes high further.

[0013] In order not to use a vacuum pump and a compressor as a means of the reduced pressure in a washing tub, and application of pressure like before, a miniaturization and low-pricing of the washing station itself were attained, and it became unnecessary moreover, to secure the power source for a vacuum

pump and compressors.

[0014]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The sectional view showing an example of the equipment used for this invention approach.

[Drawing 2] The graph which shows a sound pressure measurement result.

[Description of Notations]

1 Washing Tub

2 Lid

3 Ultrasonic Vibrator

4 Penetrant Remover

5 Circulation Piping

6 Pump

7 Filter

8 Stop Valve

9 Exhaust Pipe

10 Ejector Mechanism

11 Change-over Bulb

12 Compressed-Air Exhaust Pipe

13 Pressure Piping

14 Washed Object

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(71) 出願人 000219004

島田理工業株式会社

東京都調布市柴崎2丁目1番地3

(72) 発明者 北川 賢一

東京都調布市柴崎2丁目1番地3 島田理  
工業株式会社内

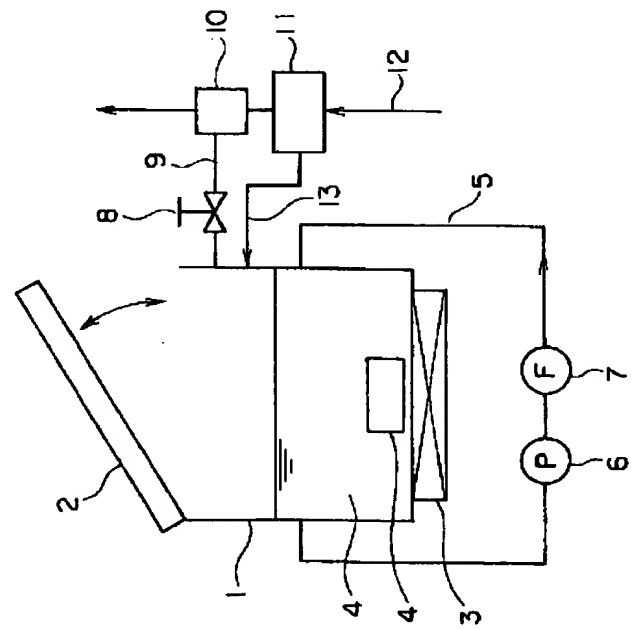
(74) 代理人 弁理士 梶村 繁郎 (外1名)

(54) 【発明の名称】 超音波洗浄方法

(57) 【要約】

【課題】 真空ポンプ及びコンプレッサーの電源確保。

【解決手段】 超音波発生源を有する洗浄槽に被洗浄物を投入し、洗浄槽内を減圧脱気後に、加圧しながら超音波洗浄し、洗浄槽内の空気を圧縮空気をエジェクターから放射することにより吸引して減圧脱気を行い、前記圧縮空気を洗浄槽内に供給して加圧する。



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## 【特許請求の範囲】

【請求項1】 超音波発生源を有する洗浄槽に被洗浄物を投入し、洗浄槽内を減圧脱気後に、加圧しながら超音波洗浄することを特徴とする超音波洗浄方法。

【請求項2】 洗浄槽内を減圧する減圧源として加圧時に使用する圧縮空気を使用することを特徴とする請求項1記載の超音波洗浄方法。

【請求項3】 洗浄槽内の空気を圧縮空気をエジェクターから放射することにより吸引して減圧脱気を行い、前記圧縮空気を洗浄槽内に供給して加圧することを特徴とする請求項1、2のいずれかに記載された超音波洗浄方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は精密機械部品又は一般の機械部品、電子部品の基板等高い清浄度が必要とされる物品を洗浄する方法に関するものである。

## 【0002】

【従来の技術】従来の前記各物品を超音波洗浄する場合には、超音波による洗浄効果が低いため、洗浄不可能となることがあった。

## 【0003】

【発明が解決しようとする課題】又、加圧、減圧する場合には、真空ポンプ及びコンプレッサーを装備していたため、洗浄装置として大型となり、真空ポンプ及びコンプレッサーの夫々について電源を確保しなければならないという欠点があった。そこで、本発明においては、洗浄液を脱気した後に加圧しながら被洗浄物を超音波洗浄することによって解決しようとするものである。

## 【0004】

【課題を解決するための手段】本発明は前記課題を解決するために、超音波発生源を有する洗浄槽に被洗浄物を投入後に洗浄槽内を減圧脱気後に、加圧しながら超音波洗浄し、洗浄槽内を減圧する減圧源として加圧時に使用する圧縮空気を使用する超音波洗浄方法を構成する。

【0005】又、洗浄槽内の空気を圧縮空気をエジェクターから放射することにより吸引して減圧脱気を行い、前記圧縮空気を洗浄槽内に供給して加圧する超音波洗浄方法を構成する。

## 【0006】

【発明の実施の形態】本発明方法を説明する前に方法に用いる装置を説明すると、図1に示すように洗浄槽1を開閉自在な蓋2で密閉できるように形成し、洗浄槽1の底壁に超音波を発生させる超音波振動子3を固定し、洗浄槽1内に洗浄液4を収容し洗浄液4を循環配管5に設けたポンプ6とフィルター7で濾過して循環させるようになっている。

【0007】一方、洗浄槽1の上部にストップバルブ8を有する排気管9を設けてエジェクター10に接続する。このエジェクター10には切換バルブ11を介して

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圧縮空気を供給する圧縮空気排気管12を接続する。更に切換バルブ11は一方を圧力配管13を介して洗浄槽1に接続して圧縮空気を送って加圧できるようになっている。尚、図中14は被洗浄物である。

【0008】前記装置を用いて本発明方法を説明すると被洗浄物14を洗浄液4に投入し、蓋2を閉じて洗浄槽1を密閉する。次に、ストップバルブ8を開けて排気管9とエジェクター10とを連通させ、切換バルブ11を操作して圧縮空気をエジェクター10に送るようにする。

【0009】このエジェクター10に圧縮空気を送って放射することにより洗浄槽内の空気を吸引して洗浄槽1内を減圧し、この減圧脱気により洗浄槽1内の空気を吸引すると同時に被洗浄物14内の隙間に存在した空気をも脱気し、この脱気に伴う洗浄液4の流れで被洗浄物14の荒洗浄を行う。

【0010】その後、ストップバルブ8を閉じ切換バルブ11を切換えると、圧縮空気は圧力配管13で洗浄槽1内に供給され、洗浄槽1内を例えば3Kg/cm<sup>2</sup>程度に加圧する。この加圧の際に超音波振動子3を駆動して超音波を被洗浄物14に照射して洗浄を行う。

【0011】本発明方法のように洗浄槽を脱気後加圧しつつ超音波を印加したところ図2に示すように常圧及び脱気後に超音波洗浄を行うよりも高い音圧が得られ、高い洗浄効果が得られた。

## 【0012】

【発明の効果】本発明は前記のように構成したもので、減圧下において被洗浄物は荒洗浄され、被洗浄物の隙間に存在する空気が脱気される。又、減圧下において脱気され、超音波による洗浄効果が高くなった洗浄液を加圧しつつ超音波洗浄するために更に洗浄効果が高くなる。

【0013】又、従来のように洗浄槽内の減圧、加圧の手段として真空ポンプ、コンプレッサーを用いないため、洗浄装置自体が小型化、低価格化が可能となり、真空ポンプ、コンプレッサー用の電源を確保する必要がなくなった。

## 【0014】

## 【図面の簡単な説明】

【図1】本発明方法に用いる装置の一例を示す断面図。

【図2】音圧測定結果を示すグラフ。

## 【符号の説明】

1	洗浄槽
2	蓋
3	超音波振動子
4	洗浄液
5	循環配管
6	ポンプ
7	フィルター
8	ストップバルブ
9	排気管

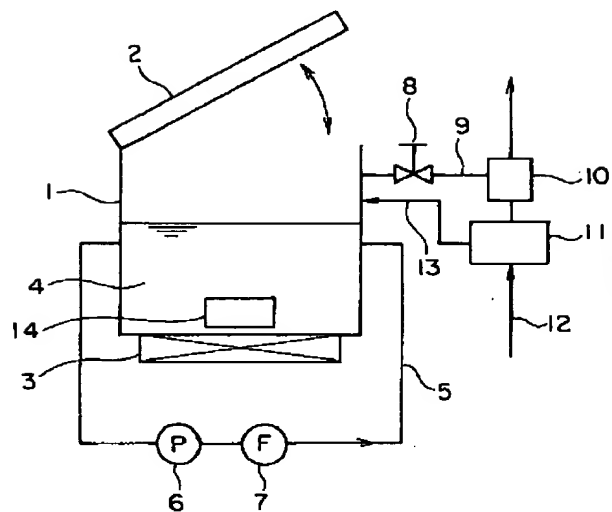
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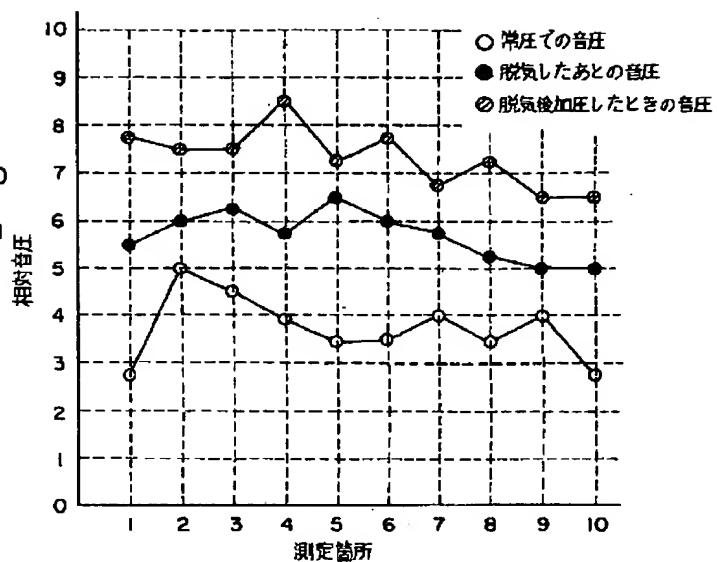
- 10 エジェクター  
11 切換バルブ  
12 圧縮空気排気管

- 13 圧力配管  
14 被洗浄物

【図1】



【図2】





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